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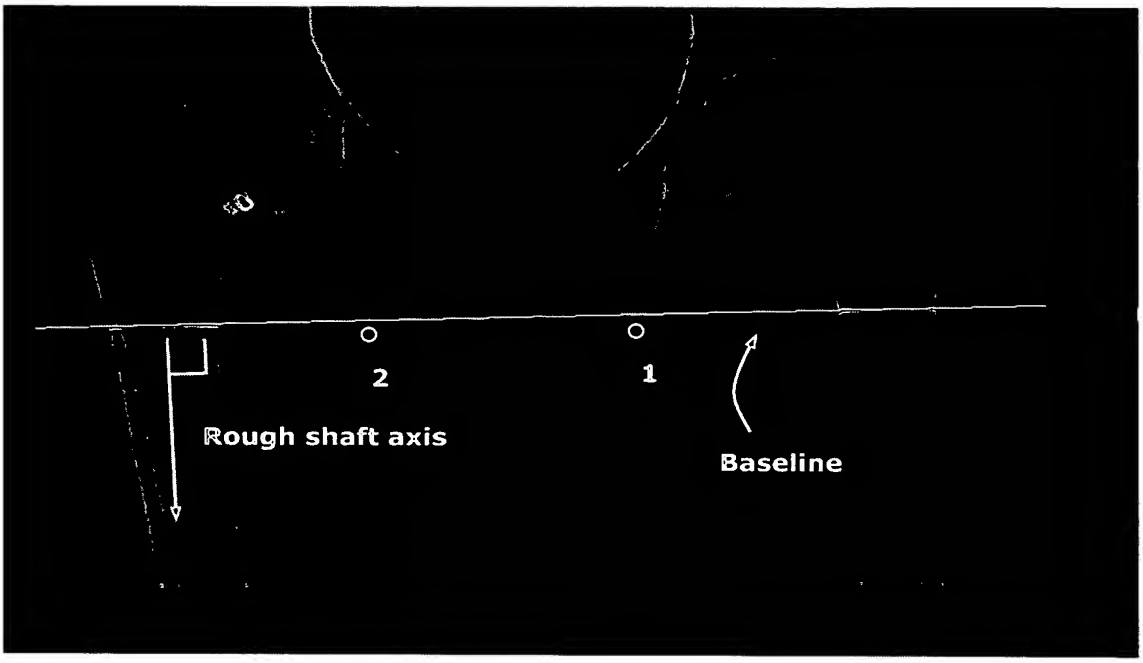

Figure 1: The two first landmarks and the defined baseline. The orthogonal direction to the baseline is used as a rough estimate of the orientation of the femoral shaft.

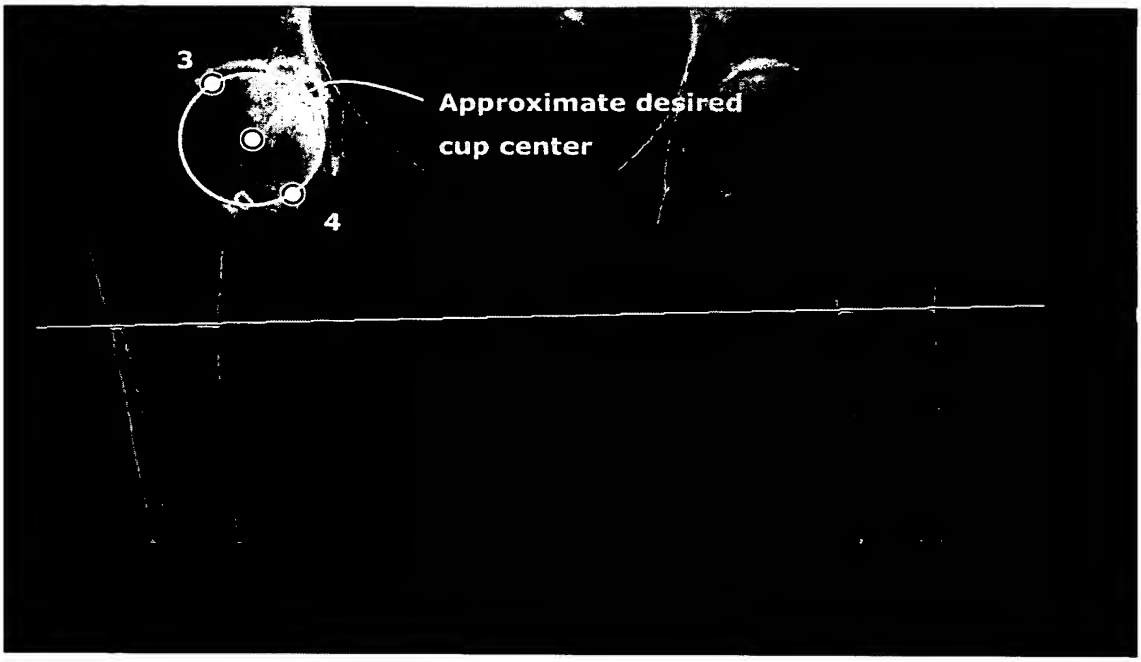

Figure 2: Third and fourth landmark indicating a desired cup center and cup diameter.

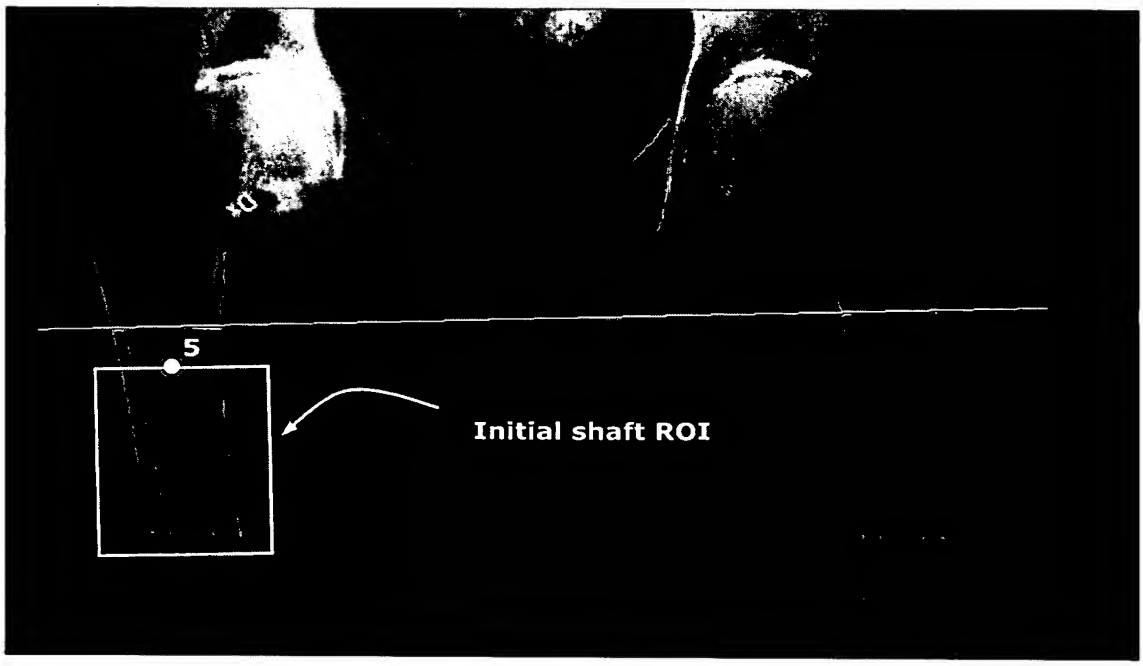

Figure 3: Fifth landmark indicating a part of the femoral shaft where a stem prosthesis is approximately desired to be fitted into the medullar space. A rectangular initial ROI is extracted with a main orientation orthogonal to the baseline.

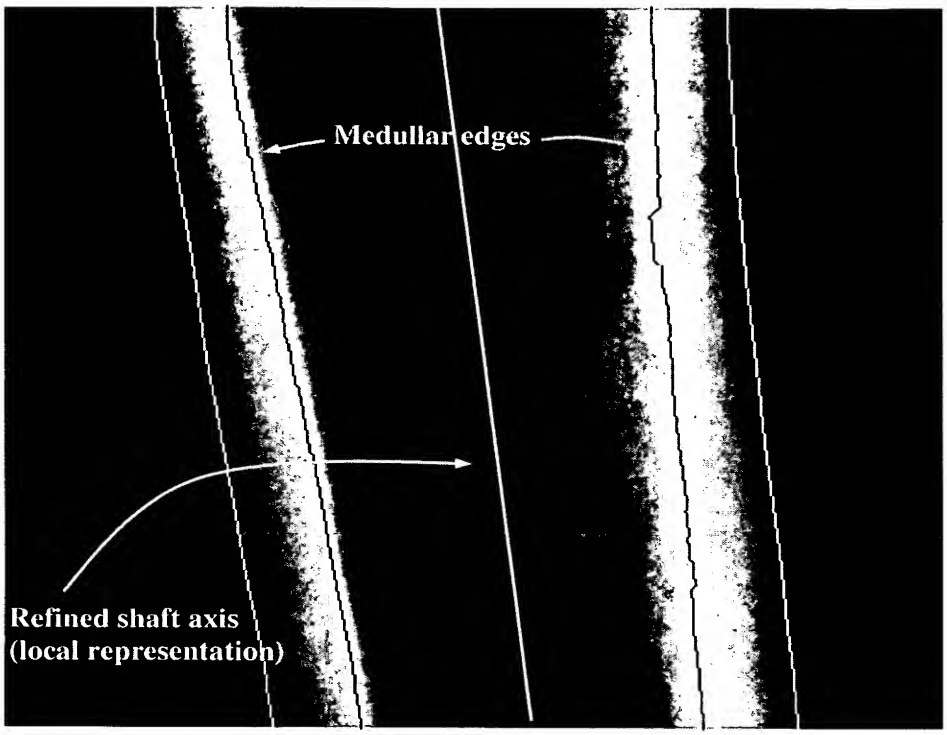

Figure 4: The initial ROI with the medullar (inner) edges detected, thereby defining the medullar space (the outlined outer edges are not used). Based on the detected inner edges a local refined shaft axis orientation is estimated (e.g. by fitting a line through the left and right edge points using orthogonal regression).

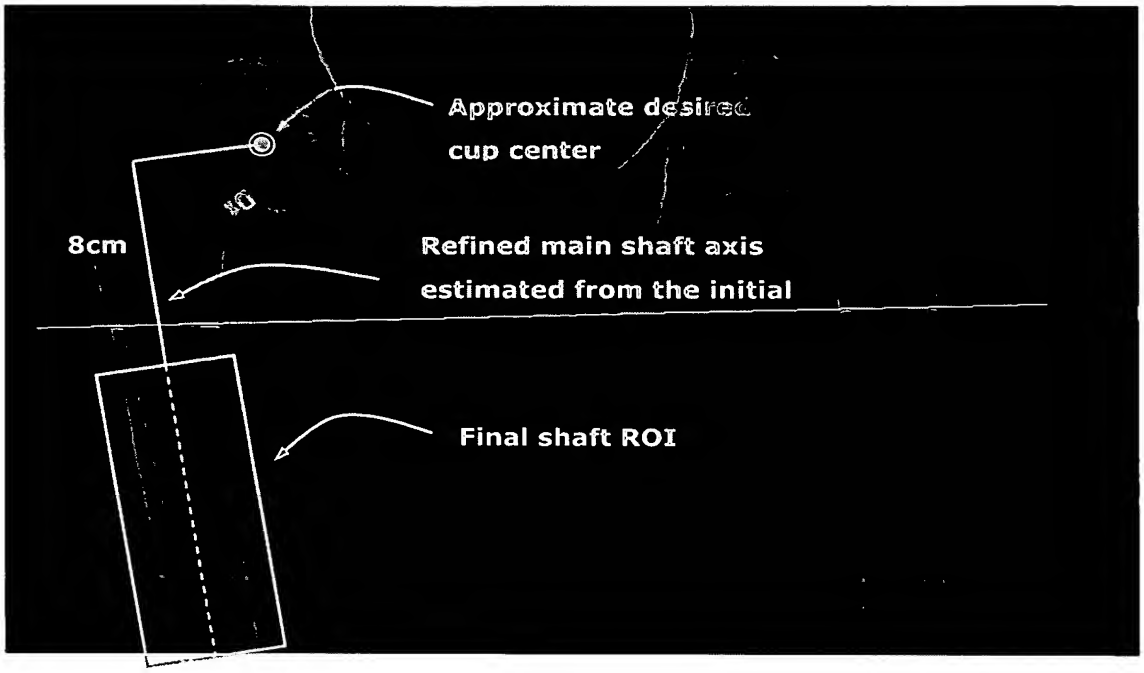

Figure 5: The global representation of the refined shaft axis from the initial ROI is calculated and used as middle column in a final shaft ROI. Thereby the orientation of the final ROI is defined. The final shaft ROI is positioned 8 cm below the cup center defined in Figure 2, calculated along the global shaft axis. The height of the final is set so that the ROI extends to the image border.

Figure 6: The final ROI with edges. The femoral medullar (inner) edges of the ROI are detected locally within the final ROI. The contours of a digital template matched with the detected edges are shown. When positioning the template, the vertical position is fixed according to the principle described in Figure 7. The horizontal position is optimized such that contour of the digital template has the same distance to the left cortex edge as to the right cortex edge.

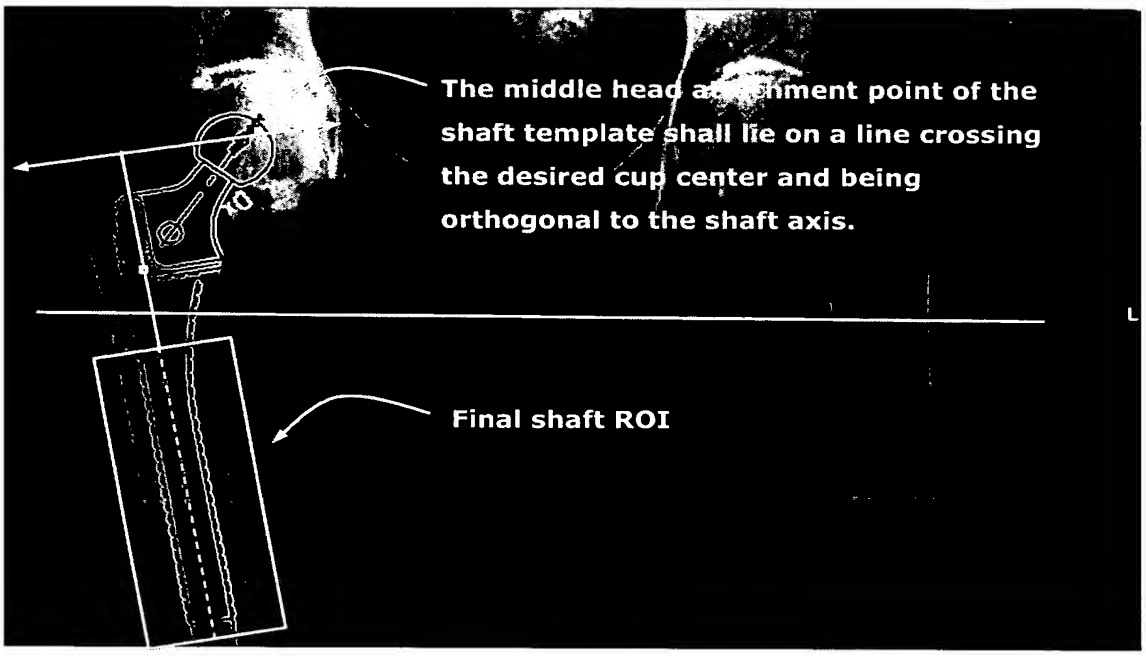

Figure 7: The contours of given digital template is matched with the edges found within the final ROI. The matching is conducted based on the global representation of the medullar edges found in the final ROI. The main axis of the shaft template is kept parallel to the shaft axis, thereby determining the orientation of the template. The position of the template along the shaft axis is fixed, such that the middle head attachment point of the stem template is on a line orthogonal to the shaft axis and going through the desired cup center. The remaining degree of freedom is the horizontal position of the template, which is optimized such that contour of the digital template has the same minimal distance to the left cortex edge as to the right cortex edge, see Figure 6.

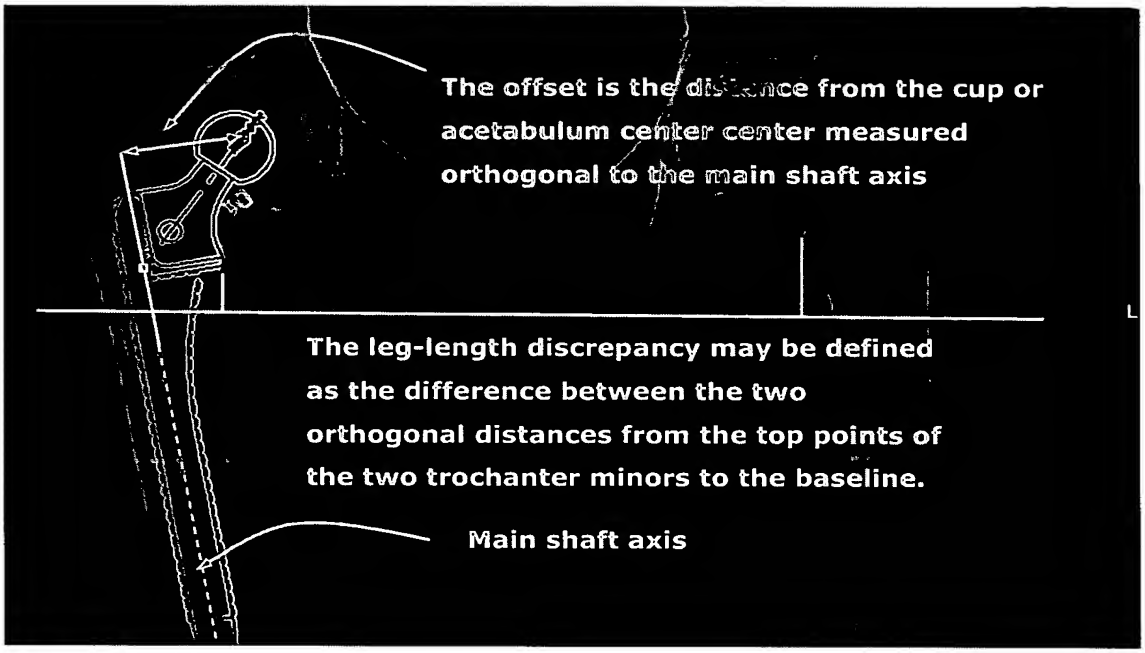

Figure 8: Offset and leg-length discrepancy definition. The offset is the orthogonal distance from the cup or acetabulum center to the main shaft axis. The leg-length discrepancy may be defined as the difference between the two orthogonal distances from the top points of the two trochanter minors to the baseline. Other definitions may also be applied.